Yrast level structure and decay of ^{137}I and neighboring nuclei from spontaneous fission of ^{252}Cf

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We have continued the spectroscopic analysis of coincident prompt γ-ray data collected in a thick ^{252}Cf source Gammasphere experiment carried out in December 1995, focusing on odd Z nuclei. The results were combined with those obtained with a thin ^{252}Cf source, measurement of γ-rays emitted in flight and simultaneous detection of both fission fragments using the CHICO PPAC array inside Gammasphere [1]. The data from the two experiments are complementary. The identification of coincident fission-partner γ-rays in the thick source spectra facilitates the initial isotope assignment of observed γ-ray cascades. Furthermore, the energy resolution of these spectra is considerably better than that of the Doppler-corrected thin source data. On the other hand, the mass resolution inherent to the thin source experiment results in lower background from partner γ-rays and from randomly overlapping transitions in other fission products. This in turn leads to less ambiguous identification and assignment of weaker γ-rays and enables the extension of level schemes to higher spin values. Moreover, the ~10 ns flight time can be used to estimate level lifetimes and γ-ray multipolarities.

We used data from the two experiments to identify and assign γ-transitions in ^{134,136}Te and in $^{135\text{-}138}$I, and to elucidate yrast level schemes for these isotopes, few nucleons above the doubly magic ^{132}Sn. In ^{137}I we identified 16 new γ-transitions between 186- and 862 keV and placed them in a level scheme with two (positive parity?) bands, extending up to spin of 37/2. There is no overlap between these yrast levels and levels previously observed in β-decay of ^{137}Te [2]. The ground-state band of ^{137}I is very similar to that reported for the even-even ^{136}Te [3], and seems to reflect a relatively loose coupling of a $g_{7/2}$ proton to the Te core. We have also been able to extend the ^{136}Te level scheme of Ref. [3] up to J=16, and to identify a number of side transitions in this nucleus. The level scheme we constructed for ^{136}I, confirms and extends the recently published [4] scheme, based on a Eurogam study of ^{248}Cm spontaneous fission. The similarity of the main features of this level scheme to those of ^{135}Te again indicates the loose coupling of the 53rd proton to Te cores. The energies of the uppermost γ-emitting levels in ^{136}I and ^{135}Te exceed the neutron binding energies of these nuclei, reflecting the angular momentum hindrance of neutron emission near yrast.

Footnotes and References

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